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A Tale of Two Urgent Food System Challenges: Comparative Analysis of Approaches to Reduce High-Meat Diets and Wasted Food as Covered in U.S. Newspapers

Jillian P. Fry [1,*], Brittany Stodden [1], Andrea M. Brace [1] and Linnea I. Laestadius [2]

[1] Department of Health Sciences, College of Health Professions, Towson University, Towson, MD 21252, USA
[2] Joseph J. Zilber School of Public Health, University of Wisconsin-Milwaukee, Milwaukee, WI 53205, USA
* Correspondence: jfry@towson.edu

Abstract: To improve food system sustainability, it is critical to reduce food loss and waste (FLW) and shift away from high-meat diets. We conducted a qualitative content analysis of 238 newspaper articles (2018–2020) to compare media framing and stakeholder involvement. For both issues, newspaper coverage often called for individual-level behavior change. Coverage of how consumers can reduce FLW was more detailed compared to diet change and portrayed numerous organizations and government agencies working in partnerships to reduce FLW. Coverage of diet change efforts portrayed substantial disagreement, including legislative efforts to restrict labeling of alternative meat and dairy products. Journalists covering new evidence on the need to shift diets for sustainability often quoted both the lead researcher and an opponent with ties to the livestock industry. Inclusion of "both sides" was similar to previous media coverage that presented climate change as an open debate for years. Strong scientific evidence shows the need to address both FLW and diet shifts to improve interconnected environmental and human health outcomes, and our analysis of media coverage shows important differences regarding how these two issues are covered in the media and approached by stakeholders in the U.S. These results can inform communication with consumers, journalists, and policymakers to more effectively translate evidence into solutions, especially at the organizational and policy levels.

Keywords: climate change; food system; food waste; news media; sustainable

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Citation: Fry, J.P.; Stodden, B.; Brace, A.M.; Laestadius, L.I. A Tale of Two Urgent Food System Challenges: Comparative Analysis of Approaches to Reduce High-Meat Diets and Wasted Food as Covered in U.S. Newspapers. *Sustainability* **2022**, *14*, 12083. https://doi.org/10.3390/su141912083

Academic Editors: Joya Kemper and Rajshri Roy

Received: 1 August 2022
Accepted: 21 September 2022
Published: 24 September 2022

1. Introduction

The global food system is a major driver of critical environmental challenges, including climate change, deforestation, and depletion and degradation of freshwater resources [1–3]. Multiple strategies at all stages of the food system are needed to transition the food system to one that operates within sustainable global limits of resource use and creation of waste products [1,4,5]. To address a lack of large-scale, coordinated efforts to resolve urgent food system issues, experts have called for approaches that include systematic monitoring and benchmarking, as well as processes that translate evidence and knowledge to policies without undue influence from well-funded corporate stakeholders [6,7].

Reducing food loss and waste (FLW) and shifting away from diets high in animal products have been identified as important for improving the environmental footprint of the global food system [1,8]. These two issues serve as excellent case studies for analysis of news coverage in that they can both be addressed through upstream interventions that place the burden of action on governments and corporations, as well as downstream interventions that emphasize responsible action by individual consumers. A social and environmental justice-oriented framing would emphasize structural, upstream solutions to these issues. Yet, prior research suggests that news coverage has emphasized individual action with regard to animal product consumption [9], while the issue of FLW coverage remains unexamined. Identifying the ways in which news coverage converges or diverges

for these two issues sheds needed light on how mass media engages with food system issues that can be addressed at multiple levels.

1.1. Food Loss and Waste

FLW includes two categories: (i) food intended to be edible that does not make it through the food supply chain to be consumed (e.g., spoiled food that is discarded), and (ii) a change in food characteristics that results in a less valuable use (e.g., using food intended for human consumption as livestock feed) [10,11]. As summarized by the U.N. Food and Agricultural Organization [10], global FLW involves about 24% of calories produced, uses 30% of global agricultural land and 7% of global water withdrawals, and produces 7% of global greenhouse gas emissions (GHGs) (excluding land use) [12,13]. When FLW and inedible organic waste (e.g., peels, cores, and yard trimmings) are discarded in landfills, the material breaks down anaerobically and releases methane, a potent greenhouse gas [14].

FLW is a problem that plagues the food system at all stages, including production, processing, transport, distribution, retail, and in households. In high-income countries, "food waste", which occurs at the retail and consumer stages, is more common, and in low-and middle-income countries there is more "food loss", which occurs at the production and distribution stages [12]. These distinct terms are used by experts working on FLW prevention and reduction, but journalists and consumers usually refer to all categories as "food waste". When food is not consumed, the resources that were used to produce, harvest, store, transport, process, package, and/or cook the food are wasted. The negative environmental impacts from each of those processes remain, and, unfortunately, do not result in people consuming the food and the macro-and micronutrients it contained. The negative impacts of FLW also extend beyond the environment to other aspects of sustainability, including social and economic impacts [15]. For example, inadequate cold storage can reduce the amount of perishable food that can be sold, resulting in lower profits for businesses and a reduced food supply.

The U.S. Environmental Protection Agency (EPA) developed the Food Recovery Hierarchy (Figure 1) to illustrate preferred approaches to reduce FLW. These are: reducing creation of surplus food, then diverting extra food to people experiencing food insecurity, followed by using food waste to feed animals, in industrial processes, and finally composting instead of sending FLW to a landfill or trash incinerator. The Food Recovery Hierarchy aligns with moving towards a circular economy where materials that have been viewed as waste products are instead utilized and processes are changed to eliminate waste; research on the intersection of FLW and transitioning to a circular economy has been emerging in recent years [16,17]. Research in the U.S. and France has found that groups addressing FLW usually do not focus on preventing FLW through source reduction, which is the most impactful approach [18].

1.2. Animal-Based Foods

In general, production of animal-based foods, including meat, seafood, dairy, and eggs, requires more resources and is responsible for higher emissions of GHGs and other pollutants compared to plant-based foods [19–21]. Poore and Nemecek (2018) found that animal products contribute about 37% of the global supply of protein and 18% of calories while using 83% of agricultural land and emitting over 70% of GHGs from agriculture [20]. Animal agriculture uses 56% of the water used for agriculture, mostly due to growing feed crops and for grazing [21], and is one of the largest sources of water pollution globally [22,23]. Agricultural expansion is a major driver of deforestation, and in Latin America, creation of new grazing land and cropland to grow feed crops are major drivers of forest loss [24,25]. Deforestation contributes to climate changes and also reduces biodiversity. Therefore, diets with higher levels of animal products have a larger environmental footprint across several important categories.

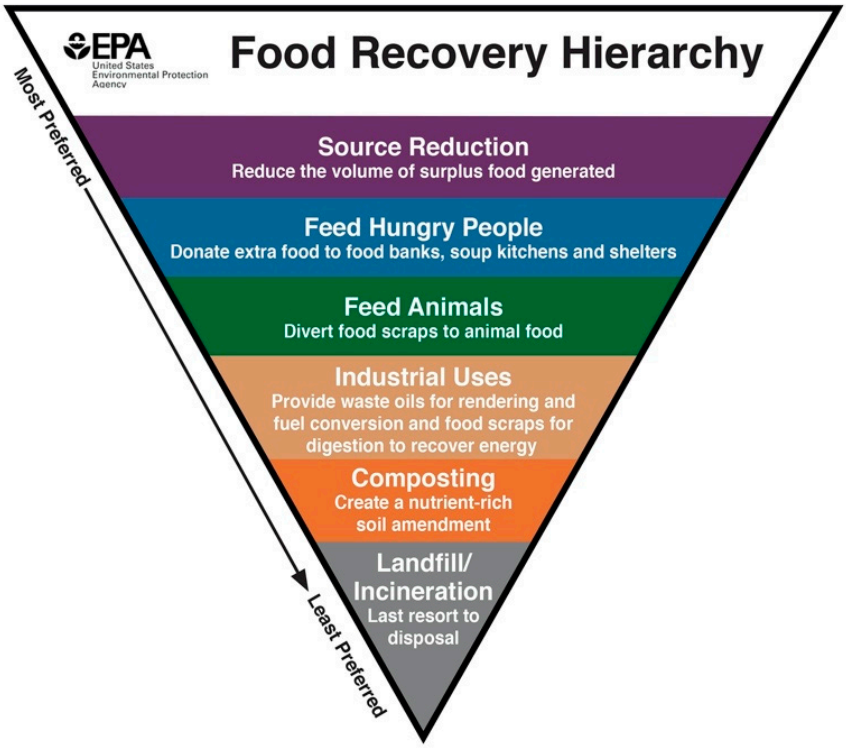

Figure 1. The Food Recovery Hierarchy (Source: U.S. Environmental Protection Agency; https://www.epa.gov/sustainable-management-food/food-recovery-hierarchy accessed on 1 July 2021).

Consumption of animal-based foods varies widely between countries, and is strongly associated with income levels. On average, high-income countries consume 1.5 times the amount of animal products (measured as average grams of protein per person per day) consumed in upper middle-income countries and 3.2 times more than lower middle-income countries [26]. These data on animal products include meat, most dairy (not butter), eggs, and fish. Average protein requirements are 47–57 g/day, depending on body size and other factors [27]; estimated protein consumption in high-income countries is 102.9 g/day/person with 58.8 g/day/person coming from animal products [26]. There are also myriad health benefits associated with eating more plant-based foods, like vegetables, fruits, legumes, nuts, and whole grains, especially in place of red and processed meat [2,28]. Specific conditions that can be prevented or improved with a healthy diet include heart disease, stroke, type-2 diabetes, and some cancers [2,28]. In many countries, especially high-income countries, consumption of animal products should be reduced for sustainability and to align with dietary needs.

1.3. Environmental Justice

Addressing FLW and high-meat diets is important for improving public health and environmental justice due to their contributions to climate change, resource depletion, and pollution. Economic disparities, racism, and other factors have created a situation where people living in low-and middle-income countries, and marginalized populations in most countries regardless of country-level wealth, are exposed to higher levels of environmental hazards and are more vulnerable to impacts of climate change and resource depletion compared to populations with more resources [29–32]. Specific examples for climate change include a limited ability to prepare for and/or recover from disasters, higher likelihood of having a job that involves exposure to extreme temperatures, barriers impacting access to healthcare, living near outdated or inadequate infrastructure that may fail during a disaster or extreme weather, and difficulty affording higher food prices that may result from crop failures due to drought or other extreme weather [31,32]. At the same time, people with

more wealth, who are less vulnerable, have lifestyles that contribute disproportionately to these issues [33], including eating more animal products, as described above.

1.4. News Coverage and Types of Actions

While consumer food behaviors are most directly determined by taste, cost, and convenience [34], there is now recognition that these factors are shaped in large part by governmental policies [35]. As illustrated by the socio-ecological model (Figure 2), public policy shapes community, organizational, inter-personal, and personal behaviors. Efforts to create food system reform can operate at any of these levels, each with different levels of efficacy and barriers to action. Placing the burden of change on individuals through voluntary action is most politically feasible [36], however, this approach has struggled with the gap between attitudes/values and actual behaviors [37], especially in the context of an unchanged food/product environment. Further, lower income individuals may lack the resources and access needed to enable more sustainable consumption choices [35]. Organizations and corporations can also adopt voluntary measures, although self-regulation remains a concern due to limited oversight from government and civil society [38]. Finally, policy action through approaches such as regulation, taxes, or subsidies, either focused on consumers or producers, are perhaps most likely to create lasting change and address questions of social and environmental justice. These types of policies would incentivize sustainable decisions by businesses or individuals and/or disincentivize less sustainable decisions. Examples include charging for garbage pickup based on weight to encourage source reduction, reuse, compost, and recycling [39]; and adding a tax on foods based on the associated GHG emissions to reduce purchases of high-emissions foods [40]. These approaches also face the greatest political obstacles to enactment [36].

Figure 2. Socio-ecological Model (Adapted from: U.S. Department of Health and Human Services Office of Disease Prevention and Health Promotion, www.healthypeople.gov/2020/law-and-health-policy-social-ecological-model-graphic accessed on 1 July 2021).

Accordingly, it is critical to examine the level of action that the media emphasizes in its coverage of these two food system issues. News media simultaneously shapes and reflects the public's perceptions of societal issues and potential solutions. Regarding coverage of an issue by news media, the amount, prominence, and framing influences readers' opinions in complex ways, including basic facts, level of importance, and how a reader believes the issue is viewed by others [41,42]. Coverage of current and/or potential courses of action to address an issue can legitimize or delegitimize various approaches through framing and amount of coverage, including weakening perceptions or support of strategies by excluding them [43]. Stakeholders engage with journalists in an effort to present their positions positively in media coverage, and coverage is influenced by stakeholders' resources, power, and effectiveness [43]. Stakeholders working on building support for policy changes often must educate journalists, policymakers, and the public on why the issue should be framed as a societal issue instead of focusing on individuals' choices [44]. For example, efforts to reduce and prevent obesity by changing diets and activity levels through policy changes, instead of focusing on education and individual-level behavior changes, has involved work on framing obesity as a public health issue with policy solutions [45].

Media analysis research has increased in recent years, and has contributed to our understanding of how societal issues are covered by the media, including public health and environmental issues. A review of studies focused on noncommunicable diseases (NCD) found that cancer, smoking, and obesity were the most common NCD topics studied via analysis of news coverage over the past few decades, and that studies most commonly examined the amount of coverage and issue framing [46]. Regarding climate change, media analysis research in the early 2000′s found that the issue was largely framed as an open debate with quotes from non-scientists linked to groups focused on denying the existence of climate change for economic gain [47]. More recently, research has shown that media has moved away from framing climate change as an open debate, quote "climate deniers" less, and frame the positions of "climate deniers" negatively [48]. In addition, climate change is now more often framed in newspapers as a public health issue [49]. These dramatic shifts occurred in tandem with changing public opinion of climate change, and likely are examples of media coverage influencing and being influenced by dominant public views. It is less clear if similar shifts have occurred for food related questions due to the very personal and culturally complex role of diets. Animal-based foods in particular were long seen as a "compulsory institutional norm" [50] (p. 329) and overall prevalence of vegan diets in the U.S. remains low [51]. Research on media coverage on the link between high-meat diets and climate change found very low levels of coverage in the U.S. in the early 2000's [52] and similar patterns in Spain and Italy from 2006 to 2013 [53]. Although an updated broad analysis of U.S. news coverage has not been conducted, a recent study examined elite media coverage in the U.S. and U.K., including The New York Times and The Wall Street Journal, and found low coverage of climate change and animal agriculture between 2006 and 2018 [9]. The authors found that when the issue was covered, the most common solution was consumers reducing meat consumption; our study expands on this work by including a broader sample of newspapers and comparing coverage of diet shifts to FLW. To our knowledge, media coverage of FLW has not been analyzed.

Although the media landscape in the U.S. has changed dramatically over the past few decades, U.S. newspapers continue to play an important role in the news media, with an estimated daily circulation of approximately 30 million (including print and digital) [54]. Polls on trustworthiness show that local newspapers rate highly and levels of trust in select national papers are high and have recently increased, compared to select cable news channels with declining trustworthiness [55,56]. Our analysis spans 2018–2020, a time period during which the publication of high-profile reports and studies on climate change, biodiversity loss, diet shifts and FLW may have increased both public awareness and news coverage. Extreme weather events also appear to have increased concern about climate change among U.S. Americans. A fall 2018 poll found that 73% of American adults thought

climate change was happening (the highest level since the poll started in 2008) and about half thought climate change contributed to extreme weather events in 2018: the wildfires in California and hurricanes Florence and Michael [57]. Unfortunately, devastating wildfires have continued in California and elsewhere since 2018, in addition to extreme weather, potentially contributing to even higher levels of concern.

1.5. Study Aims

The aims of this study were to analyze and compare three years of newspaper coverage in the U.S. on FLW and dietary shifts for environmental sustainability with emphasis on (i) current and potential strategies to address each issue, (ii) stakeholder involvement, and (iii) framing in newspaper coverage. We also considered how FLW and dietary shifts, and newspaper coverage of them, changed during the COVID-19 pandemic, which coincided with the last 10 months of the study period.

2. Materials and Methods

We performed a qualitative content analysis of newspaper articles to examine and compare media framing and coverage of strategies and stakeholder involvement regarding FLW and diet shifts. Qualitative content analysis involves developing codes and applying them to a set of data, which can be a variety of documents or interview transcripts, in order to organize, summarize, and interpret the information contained in the data [58,59]. We used Excel (Microsoft Corp., Redmond, WA, USA) and MAXQDA (VERBI Software, Berlin, Germany) software for data management, coding, and analysis.

2.1. Search Strategy

We searched LexisNexis Academic (Nexis Uni) (RELX, London, UK) and ProQuest (Clarivate, London, UK) databases from July 2020 to January 2021; the two databases included different newspapers so using both resulted in a broader search. To be included, newspaper articles had to be written in English and published in a U.S.-based newspaper between 1 January 2018 and 31 December 2020. The searches used two sets of terms: (1) "food waste" or "wasted food" and (2) (diet* OR "eat less" OR "eating less" OR "eat more" OR "eating more") AND ("food system" OR "animal agriculture" OR meat OR livestock OR beef OR plant-based OR veg* OR flexitarian OR seafood OR pescatarian OR fish) AND (climate OR sustainable OR environment). We conducted four searches, each set of search terms was used separately to search the LexisNexis and ProQuest databases. The ProQuest searches yielded a total of 1078 articles: 414 for food waste and 664 for diet shift. The LexisNexis searches yielded a total of 1419 articles: 674 for food waste and 745 for diet shift (Figure 3).

2.2. Selection of Articles

We reviewed 2497 articles, and after removing non-relevant articles and duplicates, 657 articles remained. The most common reasons for excluding articles were duplication (i.e., the same article published in multiple newspapers) or because the content of the article was not relevant (e.g., article was about a community event, general climate change news, international news, recipes, or dieting trends). Articles were included if they contained information about addressing food waste or changing diets for sustainability, even if these topics were described briefly and/or were not the main focus of the article. Due to the large number of articles, we created a 50% random sample of articles (329 out of 657) for analysis. After coding, the articles that mentioned at least one strategy or stakeholder relevant to food waste or diet change (238 articles) were analyzed by date of publication and main focus of the article (Figure 3). The articles that did not receive strategy or stakeholder codes mentioned one or both issues only briefly, rather than being a central element of the news article.

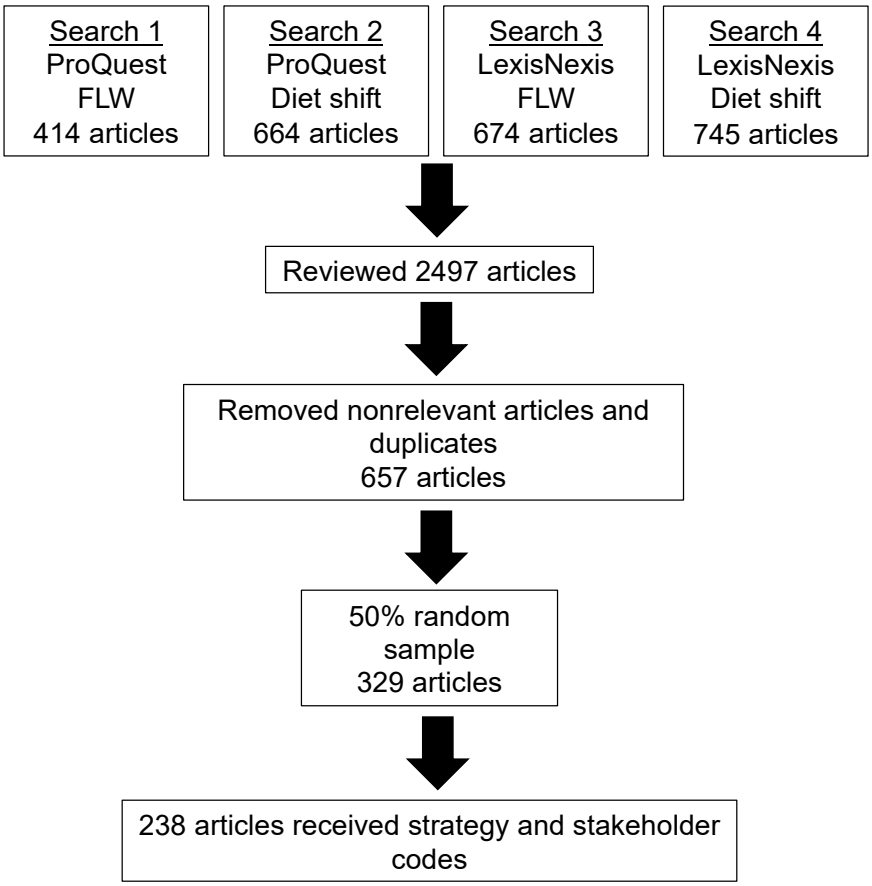

Figure 3. Steps to create sample of newspaper articles.

2.3. Coding and Data Analysis

We developed a codebook based on initial review of the articles, previous knowledge of FLW and diet shifts, the socio-ecological model, and a codebook from a previous media analysis on deforestation [60]. The codebook used in the deforestation study had clearly described codes for framing and stakeholders that informed the development of our codebook. We also refined the codebook using an inductive approach and regular meetings between coders during the coding process. The codes included descriptive information about the article (e.g., title, date, publication), the main focus of the article, and the following categories for both FLW and diet shifts: overall framing of the issue, current or suggested strategies for addressing each issue, relevant stakeholders, and food system stage(s) relevant to strategies and stakeholders (see Supplementary Materials for a list of codes).

The options for the main focus of the article were: FLW/hunger, diet shifts, health, sustainability of food production, general sustainability, and industry developments. The FLW and hunger codes were combined during analysis because the topics were often combined so it was more accurate to describe many of the articles as focused on FLW and/or hunger instead of keeping the two codes separate. Additionally, the topic of climate change was widely included in the articles, and articles often focused on one of the other topics in relation to climate change. Therefore, climate change was removed as an option for the main focus during coding to better communicate the array of topics that the articles focused on.

The framing codes were based on the aforementioned media analysis of deforestation news coverage [60], and the options were: diagnostic, symptomatic, prognostic, motivational, and dismissive (see Supplementary Materials for descriptions of the framing codes). We used an identical set of framing codes for FLW and diet shift. For example, an article that covered both topics received one framing code specific to FLW and one framing code specific to diet shift. Articles that covered only one of the topics received a single

framing code. Additionally, we coded for current or suggested strategies mentioned in the articles. Strategy codes were based on the socio-ecological model, previous knowledge of the issues, and initial review of the articles. Example strategies included raising awareness, encouraging individual behavior change, marketing, and changing the food environment. As with framing, there were two sets of strategy codes, one for FLW and an identical set for diet shifts. Codes were not mutually exclusive and multiple FLW and/or diet shift strategy codes could be applied to one article. We also applied codes based on the stage(s) of the food supply chain relevant to a strategy (e.g., production, processing, market/retail). For FLW strategies, we also coded for Food Recovery Hierarchy levels (e.g., prevention of food waste, divert food to feed other people). Lastly, we developed a list of stakeholder codes based on previous knowledge and initial review of the articles, and applied the same list of codes to FLW and diet shift content. These codes were applied to involved stakeholders mentioned in newspaper articles and to people/groups identified in coverage as a stakeholder who should be involved. Suggestions that a person or group should be involved with FLW or diet shift efforts came from the author of the article or another stakeholder. Example stakeholder codes are local or state government, non-profit organizations, food processors, and consumers.

At the start of the coding process, two members of the research team double-coded multiple groups of 6–10 articles and discussed inter-coder differences until we reached an average inter-coder reliability (ICR) score of 69.8%. Qualitative researchers generally view this ICR score as acceptable [61]. Additionally, to strengthen qualitative confirmability all segments identified as containing text on strategies and stakeholders were reviewed and analyzed by the principal investigator.

After coding, the articles that received codes for strategies and stakeholders (238 articles) were analyzed by date of publication and main focus of the article. The current and suggested strategies, stakeholders, and food system stage codes were reviewed, categorized, and summarized by issue. Then, the results for FLW and diet shifts were compared, with emphasis on similarities and differences regarding stakeholder involvement, current and suggested strategies, and framing.

3. Results

The final sample included 238 articles published in 29 U.S. newspapers (Table 1). The newspapers were located in a range of states and cities of varied sizes. The largest number of articles in the sample were published in 2019; the sample includes 71 articles from 2018, 102 articles from 2019, and 65 articles from 2020. Figure 4 shows the number of articles each year by quarter and main focus. As noted above, articles were included even if the main focus was not FLW or diet shifts, as long as the article received at least one strategy or stakeholder code. Other foci of articles included health, sustainability of food production, general sustainability, and industry developments (Figure 4). Many articles focused on these topics as they related to climate change. Due to the aims of this study and search methods employed, the description of the articles in our sample is not meant to represent all newspaper coverage of these issues during this time period.

Important topics were identified during the qualitative content analysis. First, individual behavior change and the development and availability of new products were dominant strategies for both topics that received significant media coverage. Strategies in school-based settings described in newspaper articles had similarities across the two topics, and the COVID-19 pandemic had broad impacts on the food system and resulted in media coverage related to both topics. Lastly, two topics that were identified as having important differences regarding FLW and diet shifts were (i) policy changes at various levels of government and (ii) coverage of cooperating or opposing stakeholders. The results are organized around these topics, and include some illustrative quotes and headlines. The framing codes applied to the articles helped with interpreting the articles and identifying strategies and stakeholders during the coding process, but the results of applying the framing codes did not warrant a description in the results section because they did not

provide insights as rich as the topics described above. We focus on qualitative results to provide a rich description of coverage of these issues regarding framing and approaches by stakeholders.

Table 1. Newspapers and number of articles.

Newspaper	Location	Number of Articles
Bangor Daily News	Bangor, Maine	7
Charleston Gazette-Mail	Charleston, West Virginia	1
Chicago Daily Herald	Chicago, Illinois	7
Chicago Tribune	Chicago, Illinois	7
Dayton Daily News	Dayton, Ohio	6
LNP	Lancaster, Pennsylvania	6
Los Angeles Times	Los Angeles, California	20
Pittsburgh Post-Gazette	Pittsburgh, Pennsylvania	7
Providence Journal	Providence, Rhode Island	2
Richmond Times Dispatch	Richmond, Virginia	4
St. Louis Post-Dispatch	St. Louis, Missouri	4
Star Tribune	Minneapolis, Minnesota	10
Tampa Bay Times	St. Petersburg, Florida	2
Telegraph Herald	Dubuque, Iowa	2
The Atlanta Journal-Constitution	Atlanta, Georgia	10
The Baltimore Sun	Baltimore, Maryland	8
The Bismarck Tribune	Bismarck, North Dakota	3
The Christian Science Monitor	Boston, Massachusetts	7
The New York Times	New York City, New York	42
The Philadelphia Inquirer	Philadelphia, Pennsylvania	8
The Salt Lake Tribune	Salt Lake City, Utah	1
The San Diego Union Tribune	San Diego, California	3
The Spokesman-Review	Spokane, Washington	7
The Washington Post	Washington, DC	33
The Wyoming Tribune-Eagle	Cheyenne, Wyoming	1
Tribune Review	Pittsburgh, Pennsylvania	4
USA Today	Tysons, Virginia	5
Wall Street Journal	New York City, New York	13
Wisconsin State Journal	Madison, Wisconsin	5

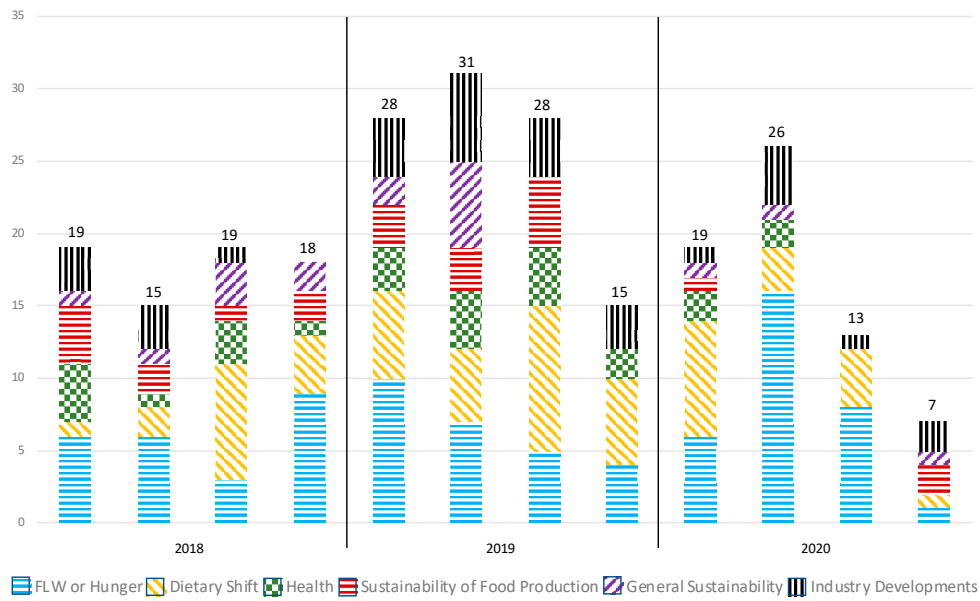

Figure 4. Number of articles by quarter and main focus.

3.1. Individual Behavior Change

For both food system issues, the most common type of strategy and stakeholder group combination was individual-level behavior change by readers/consumers, encouraged by quoted stakeholders and/or journalists/writers. Articles provided information on how to reduce FLW and/or shift diets for sustainability, reported on how some individuals are currently addressing these issues, and contained general statements by quoted stakeholders or journalists/writers about the importance of individuals changing behavior. For FLW, an example headline was "Save a little money—and stop wasting food" and articles had information on current and potential ways individuals can address the issue included changes in food shopping and storage, properly interpreting date labels, donating unwanted food, cooking with food scraps that are typically discarded, buying products that keep produce fresh longer, purchasing from companies that provide a market for misshapen or surplus produce, minimizing waste when preparing and serving a meal for a group of people, and composting at home or via a pickup service.

Articles covering current and potential individual-level behavior change related to dietary shifts were, in general, much less detailed than the FLW articles. Often, a writer or quoted stakeholder noted the importance of people eating less meat for sustainability, but no information on how people should approach diet change was included. For example, a writer recommended that readers "opt for more vegetarian and vegan options that are grown from less carbon than their carnivorous counterparts" but did not offer specific advice. Articles that had more specific information included suggestions to: try one or two meatless days per week, explore international cuisines with dishes that contain less meat and dairy, try plant-based meat and dairy substitutes (one article reviewed plant-based cheeses), eat chicken instead of beef due to a smaller environmental footprint, and make friends with vegetarians.

3.2. Development and Availability of New Products

Regarding FLW, articles highlighted restaurants and new companies that sell misshapen or surplus produce, that would otherwise be discarded, directly to consumers, including Imperfect Foods and Misfits Market. These companies were largely viewed positively, but some stakeholders had concerns about the companies attracting consumers that would otherwise shop at local farmers' markets. Coverage also described scientific innovations, such as new packaging and sensors aimed at preventing FLW; the most notable example is a plant-based coating that extends shelf-life of produce called Apeel, which has started to be used by retailers. Media coverage noted that "consumers won't pay more for Apeel produce . . . because retailers who use it save money by reducing their losses from spoilage".

A major development covered by newspapers related to dietary shifts for sustainability during the study period was the growing availability of new plant-based meat, dairy, and egg alternatives in grocery stores and restaurants, including large chain restaurants. There was also coverage, to a lesser extent, on the development and availability of blended products (e.g., burgers made with meat and mushrooms) and products made with insects. There were many articles that covered the growing sales of these products and the size and economic performance of the companies making them, most notably Beyond Meat and Impossible Foods, Inc. In addition, the development of cellular meat and seafood products, made from animal cells grown outside of an animal, received attention related to anticipation of these products becoming available soon in the U.S. (a cellular chicken product is currently sold in Singapore). Some articles quoted stakeholders that are critical of the processed nature of plant-based meat and/or the similar nutritional profile to a beef burger and lack of health benefits from switching from beef to a plant-based burger (versus health benefits associated with diets high in unprocessed plant-based foods). One article quoted a chef who said, "If the idea is to make people healthier and change the way we look at food and how we eat, we should celebrate the things we have instead of making

things in a lab". Articles covering the availability of these new food products noted high consumer demand.

In response to consumer interest, large food corporations, including meat processors like Cargill, Tyson Foods, Perdue Farms, Smithfield Foods, Inc., and Hormel Foods Corp., were reported to be creating their own plant-based and blended products and/or investing in companies developing new plant-based and cellular meat foods. Representatives of some of these companies noted the business opportunity and the benefits of diversifying their company. One said, "There is a growing demand out there. We'd be foolish not to pay attention". On the other hand, groups like the U.S. Cattlemen's Association and the National Pork Producers Council have responded to the economic threat from alternative products by advocating for labeling laws that restrict use of words like "meat" and "milk" on packaging for alternative products and opposing evidence about environmental and health benefits of reducing meat consumption in the press.

3.3. School-Based Strategies

Newspaper coverage of efforts to reduce FLW in schools included preventing waste by changing food serving methods, diverting food to others via share tables, and diverting organic waste from landfills by increasing composting. The World Wildlife Fund sponsors a school program to have these and other strategies implemented in schools.

Schools, including grade schools and universities, had implemented programs to shift towards plants to reduce the environmental footprint of the food they served. Three large public-school systems, in New York, Washington, and Virginia, were covered in newspapers for increasing plant-based options. Two universities' efforts included serving a blended burger and pledging to serve food with a lower climate impact.

In most articles about school-based strategies, it was not clear whether the FLW or diet shift strategies were aligned with sustainability content in the curriculum at the school, or if the strategies were implemented without connections to curriculum.

3.4. Policy Change

Involvement of government entities in these issues were covered in many articles, with stark differences between FLW and dietary shifts. Work on reducing FLW by local, state, and federal policymakers was multi-faceted, cooperative (with other governmental entities and non-governmental organizations), and noncontroversial. At the federal level, the U.S. Department of Agriculture (USDA) and EPA have partnered to address FLW. Newspaper coverage noted that the two agencies have made a pledge to cut food waste in half by 2030 and the agencies are working to achieve that goal by giving grants to local agencies and organizations for FLW work, issuing challenges and awards for FLW reductions by local organizations, and partnering with hundreds of businesses and nonprofit organizations. The grants described in newspaper articles in our sample were tens of thousands to several hundred thousand dollars. Coverage included information about an estimated $30 million in landfill tipping fees avoided in 2017 by organizations and companies that are part of the initiative. The initiative appears to mostly focus on diverting food to other people (i.e., food donations) and diverting organic waste (including FLW) to be composted. The FLW initiative of the USDA and EPA likely involves additional aspects, but our analysis is focused on newspaper coverage in our sample of the initiative. Additionally, at the federal level, the FDA is working on improving date labels on food packages to reduce FLW due to consumer confusion over the labels.

Around the country, state agencies gave grants to local governments and organizations for composting, purchasing equipment to store and transport donated food, and to support gleaning efforts (i.e., harvesting food that would otherwise be left in a field or an orchard). Vermont became the first state to ban throwing food waste away in the garbage, and to support the ban, the state provides curbside compost pick-up, compost drop-off locations, and resources for reducing FLW at home. Many county and city agencies have developed infrastructure for curbside compost pickup service and food rescue programs that match

food donations (including large-scale donations from restaurants, catering businesses, etc.) to meal programs. Lastly, some local agencies have partnered with nonprofit organizations to expand their FLW efforts; the partnerships have involved food waste audits, creation of waste prevention plans, and establishing food rescue programs and/or compost infrastructure. The framing of FLW efforts by local, state, and federal agencies was overwhelmingly positive in newspaper articles. There was one instance where concerns were noted about a FLW effort by a government agency: the compost pickup service in New York City was framed as expensive and slow to expand.

There were many articles where the author or a quoted stakeholder called for policymakers to become involved with shifting diets toward plants for sustainability and human health benefits. These articles generally did not include descriptions of specific, potential policy changes. For example, an expert said " ... adherence to healthy lifestyle habits is very low. Therefore, public policies should put more emphasis on creating healthy food and social environments to support and promote healthy diet and lifestyles". Articles with some specificity suggested limiting the political influence of large food corporations, reforming agricultural subsidies to incentivize sustainable and healthy food (and disincentivize resource-intensive and/or unhealthy food), and increase agricultural research and development funding focused on developing meat alternatives. Laws have been introduced in Congress and several state legislatures (and have passed in some states) that restrict use of terms like "milk" and "meat" on packages of plant-based alternatives and cellular meat. The newspaper coverage noted that lawmakers described consumer confusion and protection of dairy/meat industries as motivation for the bills. At the local level, there was a highly critical opinion piece published in response to a proposal in Los Angeles, CA that would have required concessions at city-owned properties and some large-scale entertainment venues to offer at least one vegan dish. The author strongly opposed "forcing businesses to subscribe to [the policymaker's] reducetarian worldview".

3.5. COVID-19 Pandemic

During the COVID-19 pandemic, newspaper articles described increased FLW due to widespread food chain disruptions and, in response, expanded efforts to reduce FLW. Figure 4 shows an increase in the number of newspaper articles focused on FLW and/or hunger in the second quarter of 2020. Public health measures to reduce the spread of COVID-19 resulted in a sudden near elimination of food service related to travel, restaurants, and events, and that shift lasted several months. There were also labor disruptions and outbreaks among people working in food supply chains. Articles described farmers donating or rerouting what they could and also having to destroy large quantities of food. Within weeks of the sudden disruption, there was a large, coordinated effort to purchase food from producers and collect donated food from a variety of food service businesses and divert the food to individuals and families experiencing economic hardship due to the pandemic. The effort involved a wide variety of businesses and organizations, as well as billions of dollars from federal and state government agencies. Other articles during the pandemic provided advice to readers on how to reduce FLW while minimizing trips to the grocery store, eating most meals at home, and dealing with shortages of some food products.

During the pandemic, newspaper articles described a rise in sales of plant-based meat substitutes and canned beans. There were disruptions in the U.S. meat supply due to outbreaks of COVID-19 among workers resulting in processing plants shutting down for a period of time. One article provided instructions for readers to make plant-based milk at home, and another article quoted a couple of consumers who noted that the outbreaks among meat processing plant workers and temporarily higher meat prices, combined with preexisting environmental concerns, resulted in buying plant-based meat substitutes and eating less meat.

3.6. Inclusion of "Both Sides" in Diet Shift Coverage

Newspaper articles favorably described a robust effort to reduce FLW involving partnerships among private companies, nonprofit organizations, and government agencies at the local, state, and federal levels. Journalists reported on funding provided to support FLW reduction efforts from large food companies, foundations, and state/federal agencies. Efforts focused on coordination and developing infrastructure to donate uneaten food from farmers, restaurants, caterers, food corporations, retailers, and schools to organizations that distribute food to people experiencing food insecurity. Businesses and policymakers were also expanding efforts to compost organic waste. Efforts to divert food to other people included purchasing equipment to safely store and transport large volumes of food and development of application software (i.e., "apps") that match food donations to recipient organizations.

On the other hand, newspaper coverage of diet shifts for sustainability is rife with debate. During 2018–2020, a few relevant, high-profile reports and studies by panels of experts supporting the need to shift diets for sustainability received newspaper coverage; the reports/studies focused on climate change, biodiversity, and multiple environmental and human health issues. Articles described the findings and usually quoted one or more authors of the study/report and a stakeholder opposed to the conclusions, most often someone from the U.S. Cattlemen's Association. Journalists regularly quote representatives of the U.S. Cattlemen's Association who highlight efficiency improvements in beef production and the benefits of responsible grazing and newly termed "regenerative" beef production (i.e., methods that aim to sequester carbon in soil). For example, the trade group was quoted as saying "The biggest opportunity for a healthy sustainable diet will come from reducing food waste, eating fewer empty calories and enjoying more balanced meals", in one article, and in another: " ... beef can be part of a sustainable food system ... beef cattle account for only a few percent of total greenhouse gas emissions in the U.S. while converting inedible plants like grass into usable protein".

4. Discussion

Contrasting U.S. newspaper articles about FLW and diet change reveals a clear distinction in coverage, with FLW presented as an issue with broad institutional and political support and diet change presented as more of an individual issue that is subject to controversy among stakeholders. More specifically, FLW media coverage describes involvement of government agencies, food companies, retailers, nonprofit organizations, and new companies with products and services. The two levels on EPA's Food Recovery Hierarchy that were most often addressed by current efforts were diverting uneaten food to people and diverting organic waste to be composted. In addition to involvement of many stakeholders, it was common for multiple stakeholders to partner on FLW reduction efforts by providing funding and/or coordinating efforts. While there was a great deal of coverage on growing availability and sales of meat alternatives, coverage also emphasized efforts by groups like the U.S. Cattlemen's Beef Association and state and federal lawmakers seeking to disseminate information and pass legislation to protect the livestock industry. Interestingly, newspaper articles reported that several large food companies, including meat processors, have diversified their businesses to include plant-based and/or blended products in response to consumer demand and have not aligned with meat and dairy producers' efforts to restrict labeling of alternative products.

While efforts to reduce FLW need to scale-up, the coverage consistently reflected robust, enthusiastic involvement of many organizations and substantial funding from federal and state government agencies. This approach is likely due, in part, to the proximity and visibility of the issue for an average American and a lack of negative factors associated with reducing FLW. The problems associated with throwing away uneaten food are easy for people to understand, and we can see the waste that is in front of us (either at home or as an employee at a food service business). Even the aspects of wasted food that we do not see, along the supply chain and in landfills, is simple for a consumer to grasp. In addition,

the downsides to addressing FLW are that it requires resources, including people's time, but there may be a sense of satisfaction when people participate (directly or indirectly) in efforts to reduce FLW, as suggested by research finding that retail executives/staff in the UK and consumers in Austria and Finland active in FLW efforts often view their efforts as a moral issue [62–64]. There is an economic shift involved when companies avoid millions of dollars that would have been spent on landfill tipping fees, but this shift is framed positively in newspaper coverage. Of course, landfills have limited space; also, perhaps waste management companies can diversify relatively easily by operating a composting facility.

Shifting diets is often seen as very personal, even though current dietary patterns are heavily influenced by company decisions and government policies. This individual, downstream framing is reinforced by current news coverage, placing the burden of action primarily on the individual to consume less meat. Economic shifts associated with a decrease in meat and dairy consumption are framed negatively, and potential solutions, like development of programs to support meat and dairy producers to transition to another type of food production, efforts to force producers to address externalized costs/harms, or taxes on animal products, are not commonly discussed despite growing attention among researchers [65].

New reports and studies mentioned in newspaper coverage during the study period focused on adding more evidence supporting the need to shift diets toward plants in high-income countries, but coverage of these results often included quotes from the U.S. Cattlemen's Beef Association and similar groups that sought to dismiss and contradict the conclusions. As noted earlier, media coverage of climate change commonly used a "both sides" approach for many years, despite clear scientific evidence that human-caused climate change was happening, and the climate deniers quoted in the media often had financial ties to industries that were trying to avoid efforts to address climate change. Similarly, there is clear scientific evidence that diets in high-income countries need to shift away from animal-based foods and towards plant-based foods, not only to reduce GHGs to address climate change but also to reduce resource use (e.g., land, water) and pollution, but many newspaper journalists are presenting "both sides" and, therefore, covering the issue as an open debate.

Beef producers often point to efficiency improvements and sustainable or "regenerative" production methods as evidence that there is no need to reduce beef consumption. Since this is a complex topic, these points can confuse journalists and/or consumers. Producing beef and other animal products using the most sustainable methods has some benefits, but multiple groups of experts agree that shifting diets toward plants and using sustainable production methods must be pursued simultaneously [1,2,66]. Grass-fed beef production has some environmental and animal welfare benefits compared to industrial feedlots, but there is not enough land for grazing to support high-meat diets, cows on pasture release more GHGs because it takes longer for them to reach slaughter weight, and long-term carbon sequestration potential of "regenerative" beef production is quite limited [8,67–69].

4.1. Limitations and Future Directions for Research

This is the first study to analyze and compare newspaper coverage of strategies to address FLW and dietary shifts for sustainability. This study covered a broad range of U.S. newspapers over three years and used inclusive search methods to better capture relevant newspaper articles. While data on the number of readers for each article were not available, it is notable that coverage was concentrated in newspapers with large national circulations such as The New York Times and The Washington Post. A random sample of relevant articles were coded, and the two coders had a high qualitative ICR score. However, there may be substantial efforts to address FLW and/or diet shifts that either do not typically get covered in newspapers or that we missed due to our search strategy. Additionally, there may be strategies that attract newspaper coverage due to media interest, and are included

in our study, but that represent relatively minor efforts to address FLW and/or diet shifts. Non-newspaper news sources, including blogs, were outside the scope of this study, and these issues may be written about differently in non-newspaper articles. Future research should consider how journalists prioritize coverage of different topics related to food, diet, and the environment and how that may vary between regions, both within the U.S. and across nations. Additionally, further research is needed to explore framing effects, the influence of stakeholder perspectives on consumer perceptions of dietary change and FLW, and differences in coverage and reach of newspapers and non-newspaper news sources.

4.2. Implications for Practice

The stark differences we report between how FLW and diet shifts are addressed in the U.S. should inform future efforts to better communicate the need to solve these issues to consumers, journalists, business owners, and policymakers. Effectively communicating scientific evidence to a variety of stakeholders, particularly to influence public opinion and policy decisions, is an ongoing challenge facing public health and environmental experts. During the COVID-19 pandemic, this challenge reached a crisis point and has received heightened attention [70], but there was a "translation gap" long before the pandemic [71]. Researchers point out that active, ongoing, and effective communication of scientific evidence is needed and that these efforts should be supported with funding and/or career advancement so that they are prioritized [71]. To be effective, communication efforts should have an emotional component, tailor messages for subgroups, describe benefits of addressing an issue in an accessible way, and use concise and nontechnical language to explain key points [71]. A group of obesity prevention researchers have called on scientists to approach media communication as part of a broader effort to engage with the public, aligned groups, and policymakers to build public support for strong public health policies and to create a political environment that is supportive of public health policies [45].

Specific to FLW and diet shifts, given the widespread involvement of the private and public sector in FLW efforts, we suggest exploring ways to involve these people/organizations in diet shifts. We recommend that stakeholders speaking to journalists about diet shifts provide specific examples of consumer actions, business strategies, and/or policies that would catalyze diet shifts toward plants in order to increase tangibility of calls to "eat less meat". In addition, stakeholders working on diet shifts should anticipate talking points from industry groups and provide information to journalists that show the need for moving away from high-meat diets, no matter what production methods are used.

5. Conclusions

This study adds to the literature on media coverage of environmental and public health issues to improve our understanding of how challenges, stakeholders, and individual-, organizational-, and policy-level solutions are presented to the public. The scientific evidence showing that we must dramatically reduce FLW and shift diets away from animal-based foods to create a sustainable food system and address current and emerging environmental injustices is clear. Yet, our comparison of media coverage of FLW and diet shifts highlights important differences in coverage within the U.S.

In the case of diet shifts, news coverage does not reflect the evidence and urgency with which this change should happen to address climate change and myriad additional environmental, social, and economic challenges. Still, there are significant efforts underway to address both issues; for FLW the U.S. government is leading and partnering with businesses and organizations, and work aimed at shifting diets is proceeding despite resistance from the U.S. government and "both sides" framing in newspaper articles. These results underscore the need for communication efforts that accurately portray these issues and promote impactful strategies to journalists, policymakers, and the public.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su141912083/s1.

Author Contributions: Conceptualization, J.P.F., A.M.B. and L.I.L.; methodology, J.P.F., A.M.B. and L.I.L.; formal analysis, J.P.F. and B.S.; data curation, B.S.; writing—original draft preparation, J.P.F. and B.S.; writing—review and editing, J.P.F., B.S., A.M.B. and L.I.L.; project administration, J.P.F. All authors have read and agreed to the published version of the manuscript.

Funding: The research was supported by funds from the College of Health Professions (CHP) at Towson University and the CHP Summer Undergraduate Research Institute.

Data Availability Statement: The newspaper articles used in the study are available through the LexisNexis Academic (Nexis Uni) and ProQuest databases.

Acknowledgments: The authors thank Taiya Taylor for her early assistance with the research.

Conflicts of Interest: The authors declare no conflict of interest.

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